Current Addiction Reports (2020) 7:117–124
https://doi.org/10.1007/s40429-020-00302-2

EMOTION AND ADDICTION (K MORIE, SECTION EDITOR)

Addictive Behavior Change and Mindfulness-Based Interventions: Current Research and Future Directions

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Published online: 15 February 2020

Abstract

Purpose of Review Addictive behaviors are difficult to change and result in high rates of relapse following change attempts. A number of effective treatment approaches have been developed to treat addictive behaviors (e.g., cognitive behavioral therapies). More recently, there has been an increase in the development and evaluation of mindfulness-based interventions for addictive behaviors. This article discusses the history of mindfulness-based interventions for addictive behaviors and recent advances in treatment.

Recent Findings Mindfulness-based interventions are as effective as existing evidence-based treatments for addictive behaviors. Further understanding of the neurobiological changes that occur could help identify the components of mindfulness-based interventions that are most helpful and which individuals may benefit most from mindfulness-based intervention.

Summary Additional large-scale randomized controlled trials are needed for a better understanding of the effectiveness of mindfulness-based interventions. Future research should look at optimizing mindfulness-based interventions for specific settings and patient populations, as well as dissemination and implementation.

Keywords Mindfulness · Mindfulness-based interventions · Addictive behavior · Behavior change

Introduction

Over the last few decades, secularized meditation practices have been introduced and integrated in a number of forms and into a number of settings in traditional Western healthcare practices. Mindfulness has been described as paying attention in the present moment in a particular way: on purpose and without judgment [1]. The practice of mindfulness has traditionally been associated with reductions in suffering and fostering well-being [2]. Bishop operationally defined a two-component model of mindfulness: (1) self-regulation of attention that is maintained on direct experience of the present moment, and (2) an open curiosity of one's own experience [3]. This definition highlights the importance of present-moment experience and the non-judgmental lens through which that present moment is being viewed. These two major facets of secularized mindfulness meditation are considered key components to its benefits in healthcare settings. Specifically, the non-judgmental experience of one's own immediate encounter with the world and the associated potential cessation or minimization of repetitive negative thoughts regarding one's experience may be the reason for its positive impacts in clinical settings.

The integration of mindfulness-based practices into Western mental health settings began with the development of the Mindfulness Based Stress Reduction program (MBSR) in the early 1980s [4, 5]. MBSR was developed as an intervention to help individuals suffering from chronic pain and other medical conditions. Significant reductions were observed in measures of pain, negative body image, mood disturbance, anxiety, and depression [4–6]. The success of MBSR encouraged the creation of a number of mindfulness-based interventions (MBIs) in the mental health community such as Mindfulness Based Cognitive Therapy (MBCT) [7]

This article is part of the Topical Collection on *Emotion and Addiction*

FJS was supported by a training grant (T32AA018108) from the National Institute on Alcohol Abuse and Alcoholism (NIAAA).

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and other third-wave therapies with mindfulness components such as Dialectical Behavior Therapy (DBT) [8] and Acceptance and Commitment Therapy (ACT) [9]. These programs have taken the techniques of mindfulness meditation and integrated them into more traditional behavioral health models.

Treatments for Addictive Behaviors

Addictive behaviors are considered to be relatively difficult to change given the high rates of relapse (i.e., return to the addictive behavior following a change attempt) in addictive behaviors (e.g., 40–60% of individuals relapse within one year of substance use disorder treatment) [10]. A variety of effective treatment approaches have been developed for addictive behaviors (e.g., cognitive behavioral treatment, contingency management, twelve-step facilitation, motivational interviewing) and most treatments are equally effective. Yet, there is often not a clear rationale for choosing one treatment approach instead of another. Perhaps unsurprisingly, a number of MBIs specific to addictive behavior have been developed since the creation of MBSR. Such interventions include Mindfulness Based Relapse Prevention (MBRP) [11, 12], Mindfulness-Based Relapse Prevention for Alcohol Dependence (MBRP-A) [13], Mindfulness Training for Smokers (MTS) [14], Mindfulness-Oriented Recovery Enhancement (MORE) [15], and other adaptations designed to aid in the treatment of addictive behaviors.

The impact of mindfulness in the treatment of addictive behaviors is delivered in part by promoting non-judgmental observation of thoughts and behavioral urges (e.g., cravings). By separating individuals from behavioral urges to engage in addictive behavior, individuals can observe cravings without giving in to them [16]. Addictive behavior may also be linked to the familiarity and comfort that one finds from indulging in an addictive behavior. A common pattern of behavior includes engaging in familiar, habitual actions, or acting on "autopilot" [17]. Breaking the chain of autopilot by bringing a deliberate, focused attention to the present moment may be a protective mechanism for addictive behavior.

For example, the core goals of MBRP are to cultivate awareness of internal (e.g., emotions) and external (e.g., environmental) cues related to substance use in order to create opportunities to address triggering situations rather than instinctively reacting to them in potentially harmful ways, and to practice (both imaginally and in vivo) remaining with unpleasant affective, cognitive, or physical experiences without automatically seeking to escape or avoid the situation [11, 12]. MBRP courses typically begin with a focus on experiential exercises designed to introduce the rationale for mindfulness by examining the role that "autopilot" plays in daily life and contrasting it with mindful awareness of experiences. Bodily sensations such as taste and smell are initially the focus of practice before shifting to other aspects such as sight and sound in sessions two and three. Clients are encouraged to practice exercises throughout the day to encourage exiting "autopilot" and increasing mindfulness. Mindfulness of thoughts and emotions is introduced in sessions four through six. Harmful patterns of behavior and common antecedents to relapse are identified and clients are taught to notice thoughts, sensations, or emotions that might arise. Clients are instructed to remain mindful of the present moment despite the unpleasant sensation as a method of allowing time and space to make a less-impulsive, well thought-out decision. Sessions seven and eight focus on generalizing learned practices to facilitate creating and maintaining an environment and life that can support continued practice of mindfulness and changes made to substance use.

A number of reviews and meta-analyses have explored the effects of MBIs on addictive behavior. In a meta-analysis of 42 studies that examined the effects of different mindfulness treatments of addictive behavior, Li and colleagues [18] found that mindfulness treatments were associated with superior substance misuse treatment outcomes at post-treatment and follow-up assessments compared to control conditions. More specifically, it was found that MBIs were more effective at reducing the frequency and amount of alcohol and drug use, number of drug-related problems, level of craving for substance use, and an increased rate of abstinence as compared with control conditions (e.g., treatment as usual, relapse prevention treatment, cognitive behavioral therapy, support group) [18]. Additionally, a review of 19 studies that used MBIs to treat binge eating disorder found that those interventions were associated with effects of large or medium-large magnitude and can be considered effective [19]. In a 2018 meta-analysis of MBIs, the effects of mindfulness on addiction were mixed [20]. Overall, mindfulness was superior to minimal treatment, non-specific active controls (e.g., psychological placebo groups), and specific active controls (other psychological treatments), but performed on par with no treatment control groups [20]. These mixed results may be due to the small sample size of the five studies that examined the effects of MBIs on addictive behavior but offer support for continued research into this field of study. While MBIs are increasingly applied in therapeutic settings, there remains a limited amount of research into the effects of mindfulness on addictive behavior.

In the following sections, we begin by reviewing how neuroscience may help explain the effectiveness of MBIs for addictive behaviors. We then examine results of MBIs targeted for general substance use disorder as well as individual substances and other types of addictive behavior (e.g., disordered gambling and eating), and conclude by discussing future directions for the field.

MBIs and Neuroadaptations in Addictive Behaviors

In an effort to better understand the impact of mindfulness-based interventions (MBIs) on addictive behaviors, considerable effort has been directed to understanding the underlying neurobiological changes that help support addictive behavior change. Many addictive substances and behaviors act in a similar way; they increase synaptic dopamine in the ventral striatum and increase the effects of reward-based learning [21]. These substances and behaviors enhance a positive feedback loop that reinforce continued use because of heterogeneous neuroadaptations caused by engaging in addictive behavior. As this process becomes more and more automatic, the more habitual and frequently it occurs.

Mindfulness may be beneficial at disrupting this feedback loop. One of the key tenets of mindfulness is consciously deciding what intero- and exteroceptive stimuli to engage with [22]. Meditation may serve to disrupt the automatic response that can lead to engaging in addictive behavior. There tends to be a bottom-up habitual response to learned behavioral cues or antecedents such as stress and environment, and mindfulness may be beneficial in decreasing or eliminating habitual responses. The practice of mindfulness may broaden an individual's focus of attention from the limited cues that triggered addictive behavior to the broader experience of interoceptive information that was previously unnoticed [23]. The focused attention required to engage in a mindfulness practice may help rectify dysfunctional habit behaviors and craving by strengthening connectivity within the prefrontal cortex, anterior cingulate cortex, and parietal networks, and between the attentional control network and the habit and craving circuits [23]. In short, mindfulness may be a tool that has the ability to break the neurobiologically mediated behavioral feedback loop of addictive behavior and may be beneficial in correcting dysregulated networks that have adapted to repeated engagement in addictive behavior. Further research is needed in order to determine exactly which neural networks are affected by contemplative practices.

MBIs for Substance Use Disorder

A number of studies have investigated the use of mindfulness-based interventions (MBIs) for various diagnoses of substance use disorder. Recent studies have investigated MBIs as standalone interventions as well as combining MBIs with existing interventions. One study of 180 male participants with co-occurring substance use and psychiatric disorders found that individuals randomized to the Mindfulness-Oriented Recovery Enhancement (MORE) condition reported significantly less craving than individuals in the treatment as usual (TAU) condition [24]. In addition to a reduction in cravings, participants in the MORE condition had significant improvements in trait mindfulness and overall mental health [24]. Himelstein and colleagues [25] conducted a study with 44 incarcerated adolescents residing in a detention camp that had been referred to a substance use treatment program. Results indicated improvements in mental health outcomes and a significantly greater increase from pre- to post-intervention in self-esteem among those in the MBI condition versus those in the TAU condition [25]. Both studies [21, 22] suggest continued research on the use of MBIs for substance use disorder given the observed improvements in mental well-being.

Alizadehgoradel and colleagues [26] conducted an RCT of mindfulness-based substance abuse treatment (MBSAT)—translated and adapted for use in Iran—compared against waitlist control with 40 Iranian adolescents. Participants receiving the MBI reported significantly improved response inhibition, risky decision-making, working memory, and cognitive flexibility relative to control. Davis and colleagues [27] conducted an RCT comparing rolling group MBRP for young adults receiving inpatient substance use disorder treatment ($n = 45$) and treatment as usual plus 12 step/self-help ($n = 34$). Participants in the MBRP condition reported reductions in facets of trait impulsivity, although only positive and negative urgency mediated the relationship between condition and substance use.

Combining mindfulness interventions with other treatment modalities may help enhance outcomes and increase the ease of integrating mindfulness into clinical settings. Valls-Serrano and colleagues [28] combined Mindfulness Meditation with Goal Management Training to see if the combination of interventions improved outcomes for individuals with polysubstance use disorder already enrolled in a substance use disorder treatment program. They found individuals in the combined intervention showed improvements in working memory and reflection-impulsivity/decision-making [28]. Although the study did not formally assess substance use, the results demonstrate the potential for integrating mindfulness techniques with existing interventions.

MBIs for Smoking

Mindfulness approaches have been used as both monotherapy and an adjunct to existing smoking cessation treatment. Studies have found that mindfulness training is helpful for individuals attempting to decrease smoking or achieve smoking abstinence [29, 30]. More recently, Davis et al. [31] found that among low socioeconomic status smokers ($n = 198$), abstinence rates were significantly higher for participants receiving an MBI, Mindfulness Training for Smokers (MTS), than participants in the control condition (telephonic quit line) at six-month follow-up. Davis et al. [32] followed up this study by comparing MTS against a time/intensity matched control—the American Lung Association's Freedom from Smoking (FFS), smoking cessation protocol. Participants ($n = 175$) were

recruited from a low socioeconomic status area. Abstinence rates between groups were nearly identical four weeks post-quit. Twenty-four weeks post-quit, MTS trended toward higher abstinence rates but were not statistically significant. However, MTS participants demonstrated a significantly larger decrease in urge intensity from baseline to post-quit, and significantly larger decreases in stress and experiential avoidance at 24-weeks post-quit. Kober and colleagues [33] conducted functional magnetic resonance imaging (fMRI) on 23 participants that completed either mindfulness training or the FFS smoking cessation protocol. Stress reactivity in several brain regions was found to be related to reductions in smoking post-treatment and at three-month follow-up. Participants in the mindfulness training condition showed lower stress reactivity compared with the FFS condition.

Ruscio et al. [34] compared a brief MBI with a "sham meditation" control in an ecological momentary assessment study. Participants ($n = 44$) reported significantly reduced negative affect, reduced craving immediately post-meditation, and reduced cigarettes smoked per day over time in the mindfulness intervention condition relative to control. Singh et al. [35] conducted a randomized controlled trial (RCT) to extend previous findings comparing a three-component MBI for smoking cessation with a treatment as usual control condition among individuals with mild intellectual disabilities ($n = 51$). Participants in the MBI condition reported significantly higher abstinence rates at post-treatment and significantly fewer mean cigarettes smoked at one-year follow-up.

However, not all studies of MBIs for smoking cessation have found positive results. Vidrine et al. [36] did not find significant differences in treatment effects on smoking abstinence rates between an MBI and a cognitive behavioral treatment (CBT) among 412 participants. The study reported similar abstinence rates relative to other MBIs [e.g., 31, 32]; however, abstinence rates in this study were higher than those seen in the Davis studies. Maglione and colleagues [37] conducted a systematic review and meta-analysis on the efficacy of mindfulness meditation for smoking cessation. They identified a number of study limitations and did not find a significant difference between the studies reviewed and control conditions. While the data indicates that the MBIs appeared to be as effective as the standard of care control, the studies were not designed to test for effectiveness equivalence. The authors go on to suggest that further rigorous, well-designed, and large RCTs are needed to develop a larger evidence base to provide more accurate estimates of effectiveness.

MBIs for Alcohol

Much of the early research on MBIs for addictive behavior in the USA has focused on alcohol use [e.g., 38]. Recent studies have started to dig deeper into the effects of MBIs using specific types of interventions (e.g., brief interventions) and antecedents to drinking (e.g., craving). A pilot study of 76 undergraduate binge drinkers found that engaging in a brief MBI (two, 10–20-minute guided mediations and a consultation with a therapist who provided a handout briefly explaining mindfulness) predicted a more than two-fold decrease in having a binge drinking episode relative to control [39]. The study offers preliminary support to suggest that brief engagement in MBIs may help decrease heavy drinking. The researchers suggest that participation in the mindfulness group led to more awareness of craving cues, and that these techniques are compatible with a harm reduction approach to alcohol consumption [39].

Szeto, Shoenmakers, de Mheen, and Snelleman [40] conducted an ecological momentary assessment study that looked at the effects of mindfulness on cravings. Participants were recruited from three outpatient substance use disorder treatment facilities in the Netherlands ($n = 43$). The study found an association between participant mindfulness and craving, such that as mindfulness increased craving decreased, suggesting that mindfulness may help reduce cravings which in turn may reduce the number of drinking episodes [40, 41]. Despite the early research emphasis on MBIs and alcohol, many studies conducted have been on a small scale. While the findings appear to be positive, they highlight the need to conduct large-scale trials to learn more about the impact of MBIs on alcohol use.

MBIs for Opioids

Imani and colleague [42] conducted an RCT of mindfulness-based relapse prevention (MBRP; using a protocol translated into Farsi) compared with TAU among adults with opioid dependence (DSM-IV-TR criteria) in Iran ($n = 30$). Participants in the MBRP condition reported significantly less opioid use than the control condition at post-treatment. Unfortunately, the study did not conduct any follow-up beyond post-treatment.

More recent pilot studies have examined the effectiveness of MBIs for individuals with chronic pain and opioid use disorder (OUD). Garland and colleagues [43] found that 8 weeks of MORE was more effective than TAU in reducing craving, pain unpleasantness, and stress, as well as significantly greater positive affect among 30 patients enrolled in a methadone maintenance program. Vowles and colleagues [44] studied 37 veterans with chronic pain and hazardous opioid use who were enrolled in a co-occurring disorders medical clinic and found that 12 weeks of MBRP combined with ACT was more effective than TAU in reducing opioid misuse, pain interference, and pain behavior at 6-months following treatment. Although both of these studies were small, they demonstrate the potential effectiveness of MBIs for targeting both chronic pain and OUD, which is a significant public health crisis [45].

MBIs for Disordered Eating

There is a growing body of evidence that suggests that an addictive process may play a role in certain types of disordered eating (e.g., food addiction) [46, 47]. MBIs have been applied to both clinical (e.g., anorexia) and subclinical (e.g., emotional eating) disordered eating. Kristeller and colleagues [48] developed Mindfulness-Based Eating Awareness Training (MB-EAT), a 12-session group therapy, for binge eating disorder. They conducted an RCT ($n = 150$) and participants were randomly assigned to the MB-EAT condition, a psychoeducational/cognitive behavioral therapy, or wait list control. Participants in the intervention conditions reported fewer binge days per month and lower levels of depression relative to control at the one- and four-month follow-ups. At four-month follow-up, 95% of MB-EAT participants no longer met criteria for binge eating disorder and binges that occurred were likely to be significantly smaller. Additionally, amount of mindfulness practice was related to improvements on the Binge Eating Scale, disinhibition ratings, and weight. However, the study faced high participant dropout rates and was not compared against "gold standard" manualized treatments.

Levoy and colleagues [49] conducted an exploratory study of mindfulness-based stress reduction (MBSR) for emotional eating. Three hundred forty-eight participants completed the MBSR intervention and participants reported significantly improved emotional eating scores and the scores were related to changes in self-reported mindfulness. However, the study lacked a control group. Katterman et al. [50] conducted a systematic review of MBIs for a variety of subclinical eating problems. The results suggested that MBIs are effective treatments for binge eating and emotional eating. However, only two of the studies included a comparison condition and those studies did not find a significant difference between MBI and control.

MBIs for Gambling

McIntosh and colleagues [51] conducted a seven-week RCT comparing manualized cognitive behavioral therapy (CBT) and a problem gambling MBI with case-formulated CBT for problem gamblers in Australia ($n = 77$). All three interventions resulted in large effect sizes at post-treatment and three- and six-month follow-ups. However, the study results are somewhat confounded due to three of the seven intervention weeks being psychoeducation that was received by all participants, regardless of condition.

Toneatto et al. [52] compared a five-week mindfulness-enhanced cognitive behavioral therapy (ME-CBT) with wait list control among problem gamblers ($n = 18$). Participants in the ME-CBT condition reported fewer problem gambling symptoms and gambling urges at post-treatment and three-month follow-up. However, the study was limited by a modest sample size and use of wait list control.

Shead et al. [53] compared daily audio-guided mindfulness meditation with an audiobook recording control among gamblers ($n = 39$). Participants in the MBI condition reported significantly fewer cravings than participants in the control condition. However, the MBI did not decrease delay discounting (another construct of interest). The study was limited by most participants not meeting criteria for problem gambling and it also lacked a follow-up.

Maynard and colleagues [54] conducted a meta-analysis of MBIs in the treatment of disordered gambling. Reviewing studies dating back to 1980, they found that the MBIs had moderate to large effects for gambling behavior/symptoms and financial outcomes. However, they found similar results as to what is reported above suggesting that further studies, RCTs, and a clearer definition of mindfulness would be helpful for drawing conclusions regarding the effectiveness of MBIs for problem gambling.

MBIs for Internet Gaming Disorder

With the rise of affordable computers and high-speed internet, rates of individuals playing video games on the internet and offline are increasing with an estimated 4–12% of adolescents and adults exhibiting problematic gaming behaviors [55]. Rates of internet gaming disorder (IGD) are on the rise and IGD has been found to be associated with a range of negative consequences (e.g., impaired physical health [56] and loss of employment and relationships [57]). Li and colleagues [58] conducted an eight-week RCT comparing group-based Mindfulness-Oriented Recovery Enhancement (MORE) for IGD with a support group control. Participants in the MORE condition reported a greater decrease in DSM-5 symptoms, video game craving, and maladaptive gaming cognitions at post-treatment and three-month follow-up. Li and colleagues [59] used the same sample to investigate the effect of potential mediators. They found that the effects of MORE on IGD was mediated through pre-to-post-treatment reductions in maladaptive gaming cognitions. Yao and colleagues [60] conducted a non-RCT, six-week group-based intervention blending reality therapy and mindfulness meditation for individuals with IGD ($n = 25$). After completing the MBI, participants reported decreased delay discounting rate and IGD severity. Participants were not randomly assigned to the control condition, preventing us from drawing conclusions across conditions. Overall, these results provide initial support for continued investigation of the effectiveness MBIs for IGD.

Conclusions and Future Directions

The growing field of mindfulness-based interventions (MBIs) for substance use disorders has yielded mixed results. While some studies have yielded positive results, others have found that MBIs perform no better than existing treatments or control conditions. However, there are a number of study limitations and confounds that make it difficult to draw firm conclusions. As a result, there is a pressing need for large-scale RCTs with equivalent control conditions and appropriate follow-ups. Many of the existing studies have small sample sizes, lack equivalent time/effort controls, and the results of the studies have small effect sizes with large confidence intervals. Conducting large RCTs may help provide a clearer picture of the effectiveness of MBIs. It is also important to begin to study whether MBIs may be more or less effective for particular patients with substance use disorders and in what settings. Based on existing results, it seems likely that MBIs are at least equivalent in effectiveness to existing treatments for addictive behaviors, in general, and may be more effective for individuals with more severe comorbid negative affect and substance use disorder symptoms [61]. When reviewing treatment outcomes for addictive behaviors, it is clear there is no "one size fits all" treatment. This suggests developing a better understanding of what factors predict the best MBI outcomes, consistent with a precision medicine approach.

The fact that mindfulness has been used for centuries in some form to help with the fleeting and sometimes difficult nature of the human mind appears to have inspired researchers to determine what benefits this ancient practice may have in clinical settings. A majority of the MBIs reviewed have been adapted from existing practices of MBIs focused on other areas of dysfunction. The results seem to indicate that the underlying concept of mindfulness appears to be a viable intervention option for addictive behaviors. We are hopeful that continued research will shine light on the best role mindfulness can play in the treatment of addictive behaviors, and will also help develop the most beneficial and effective way to integrate mindfulness into existing addiction programs. Interest in mindfulness and its benefits in the clinical setting are continuously growing, and the results from future research will show us the best contexts and settings for its use.

References

1. Kabat-Zinn JCN-BMK 1994. Wherever you go, there you are: mindfulness meditation in everyday life. 1st ed. New York: Hyperion; 1994.
2. Nhất Hạnh TCN-B. N 1999. The heart of the Buddha's teaching: transforming suffering into peace, joy & liberation: the four noble truths, the noble eightfold path, and other basic Buddhist teachings. 1st Broadw. New York: Broadway Books; 1999.
3. Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J, et al. Mindfulness: a proposed operational definition. Clin Psychol Sci Pract. 2004;11:230–41.
4. Kabat-Zinn J, Lipworth L, Burney R. The clinical use of mindfulness meditation for the self-regulation of chronic pain. J Behav Med [Internet]. 1985;8:163–90 Available from: http://link.springer.com/10.1007/BF00845519.
5. Kabat-Zinn J, Lipworth L, Burney R, Sellers W, Brew M. Reproducibility and four year follow-up of a training program in mindfulness meditation for the self-regulation of chronic pain. Pain [Internet]. 1984;18:S303 Available from: http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00006396-198401001-00451.
6. Kabat-Zinn J. An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: theoretical considerations and preliminary results. Gen Hosp Psychiatry [Internet]. 1982;4:33–47 Available from: https://linkinghub.elsevier.com/retrieve/pii/0163834382900263.
7. Segal ZV, Williams JMG, Teasdale JDCN-R. S 2002. Mindfulness-based cognitive therapy for depression: a new approach to preventing relapse. New York: Guilford Press; 2002.
8. Linehan M. Cognitive-behavioral treatment of borderline personality disorder. In: Diagnosis Treat. Ment. Disord. CN - RC569.5.B67 L56 1993. New York: Guilford Press; 1993.
9. Hayes SC, Strosahl K, Wilson KGCN-RCH 1999. Acceptance and commitment therapy: an experiential approach to behavior change. New York: Guilford Press. p. 1999.
10. Abuse NI on D. Principles of drug addiction treatment: a research based Guide (3rd Ed.) [Internet]. NIH Publ. Rockville, MD: National Institute on Drug Abuse; 2018.
11. Bowen S, Chawla N, Marlatt GACN-R. B 2011. Mindfulness-based relapse prevention for addictive behaviors: a clinician's guide. New York: Guilford Press; 2011.
12. Witkiewitz K, Marlatt GA, Walker D. Mindfulness-based relapse prevention for alcohol and substance use disorders. J Cogn Psychother [Internet]. 2005;19:211–28 Available from: http://connect.springerpub.com/lookup/doi/10.1891/jcop.2005.19.3.211.
13. Zgierska AE, Shapiro J, Burzinski CA, Lerner F, Goodman-Strenski V. Maintaining treatment fidelity of mindfulness-based relapse prevention intervention for alcohol dependence: a randomized controlled trial experience. Evidence-Based Complement Altern Med [Internet]. 2017;2017:1–12 Available from: https://www.hindawi.com/journals/ecam/2017/9716586/.
14. Brewer JA, Sinha R, Chen JA, Michalsen RN, Babuscio TA, Nich C, et al. Mindfulness training and stress reactivity in substance abuse: results from a randomized, controlled stage I pilot study. Subst Abus [Internet]. 2009;30:306–17.
15. Garland EL, Manusov EG, Froeliger B, Kelly A, Williams JM, Howard MO. Mindfulness-oriented recovery enhancement for chronic pain and prescription opioid misuse: results from an early-stage randomized controlled trial. J Consult Clin Psychol [Internet]. 2014;82:448–59 Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/a0035798.
16. Marlatt A. Substance abuse treatment and the stages of change. Addiction [Internet]. 2002;97:607–8 Available from: http://doi.wiley.com/10.1046/j.1360-0443.2002.t01-8-00166.x.
17. Tiffany ST, Drobes DJ. Imagery and smoking urges: the manipulation of affective content. Addict Behav [Internet]. 1990;15:531–9 Available from: https://linkinghub.elsevier.com/retrieve/pii/030646039090053Z.
18. Li W, Howard MO, Garland EL, McGovern P, Lazar M. Mindfulness treatment for substance misuse: a systematic review and meta-analysis. J Subst Abuse Treat [Internet]. 2017;75:62–96 Available from: https://linkinghub.elsevier.com/retrieve/pii/S0740547216302409.

19. Godfrey KM, Gallo LC, Afari N. Mindfulness-based interventions for binge eating: a systematic review and meta-analysis. J Behav Med [Internet]. 2015;38:348–62 Available from: http://link.springer.com/10.1007/s10865-014-9610-5.
20. Goldberg SB, Tucker RP, Greene PA, Davidson RJ, Wampold BE, Kearney DJ, et al. Mindfulness-based interventions for psychiatric disorders: a systematic review and meta-analysis. Clin Psychol Rev [Internet]. 2018;59:52–60 Available from: https://linkinghub.elsevier.com/retrieve/pii/S0272735817303847.
21. Brewer JA, Garrison KA. The posterior cingulate cortex as a plausible mechanistic target of meditation: findings from neuroimaging: the PCC as a target of meditation. Ann N Y Acad Sci [Internet]. 2014;1307:19–27 Available from: http://doi.wiley.com/10.1111/nyas.12246.
22. McConnell PA, Froeliger B. Mindfulness, mechanisms and meaning: perspectives from the cognitive neuroscience of addiction. Psychol Inq [Internet]. 2015;26:349–57.
23. Garland EL, Froeliger B, Howard MO. Mindfulness training targets neurocognitive mechanisms of addiction at the attention-appraisal-emotion interface. Front Psychiatry [Internet]. 2014;4:173.
24. Garland EL, Roberts-Lewis A, Tronnier CD, Graves R, Kelley K. Mindfulness-oriented recovery enhancement versus CBT for co-occurring substance dependence, traumatic stress, and psychiatric disorders: proximal outcomes from a pragmatic randomized trial. Behav Res Ther [Internet]. 2016;77:7–16 Available from: https://linkinghub.elsevier.com/retrieve/pii/S0005796715300619.
25. Himelstein S, Saul S, Garcia-Romeu A. Does mindfulness meditation increase effectiveness of substance abuse treatment with incarcerated youth? A pilot randomized controlled trial. Mindfulness (N Y) [Internet]. 2015;6:1472–80 Available from: http://link.springer.com/10.1007/s12671-015-0431-6.
26. Alizadehgoradel J, Imani S, Nejati V, Fathabadi J. Mindfulness-based substance abuse treatment (MBSAT) improves executive functions in adolescents with substance use disorders. Neurol Psychiatry Brain Res [Internet]. Imani, Saeed, Department of Clinical and Health Psychology, Faculty of Psychology and Educational Sciences, Shahid Beheshti University, P.O. Box 1983963113, 193954716, Tehran, Iran: Elsevier Science; 2019;34:13–21. Available from: http://offcampus.lib.washington.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2019-73994-003&site=ehost-live
27. Davis JP, Barr N, Dworkin ER, Dumas TM, Berey B, DiGuiseppi G, et al. Effect of mindfulness-based relapse prevention on impulsivity trajectories among young adults in residential substance use disorder treatment. Mindfulness (N Y) [Internet]. Davis, Jordan P., Department of Children, Youth, and Families Suzanne Dworak-Peck School of Social Work, University of Southern California, 669 W 34th Street, Los Angeles, CA, US, 90089: Springer; 2019; Available from: http://offcampus.lib.washington.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2019-25673-001&site=ehost-live
28. Valls-Serrano C, Caracuel A, Verdejo-Garcia A. Goal management training and mindfulness meditation improve executive functions and transfer to ecological tasks of daily life in polysubstance users enrolled in therapeutic community treatment. Drug Alcohol Depend [Internet]. 2016;165:9–14 Available from: https://linkinghub.elsevier.com/retrieve/pii/S0376871616301156.
29. Bowen S, Marlatt A. Surfing the urge: brief mindfulness-based intervention for college student smokers. Psychol Addict Behav [Internet]. 2009;23:666–71 Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/a0017127.
30. Davis JM, Fleming MF, Bonus KA, Baker TB. A pilot study on mindfulness based stress reduction for smokers. BMC Complement Altern Med [Internet]. 2007;7(2) Available from: https://bmccomplementalternmed.biomedcentral.com/articles/10.1186/1472-6882-7-2.
31. Davis JM, Goldberg SB, Anderson MC, Manley AR, Smith SS, Baker TB. Randomized trial on mindfulness training for smokers targeted to a disadvantaged population. Subst Use Misuse [Internet]. 2014;49:571–85.
32. Davis JM, Manley AR, Goldberg SB, Smith SS, Jorenby DE. Randomized trial comparing mindfulness training for smokers to a matched control. J Subst Abuse Treat [Internet]. 2014;47:213–21.
33. Kober H, Brewer JA, Height KL, Sinha R. Neural stress reactivity relates to smoking outcomes and differentiates between mindfulness and cognitive-behavioral treatments. Neuroimage [Internet]. 2017;151:4–13.
34. Ruscio AC, Muench C, Brede E, Waters AJ. Effect of brief mindfulness practice on self-reported affect, craving, and smoking: a pilot randomized controlled trial using ecological momentary assessment. Nicotine Tob Res [Internet]. 2015:ntv074 Available from: https://academic.oup.com/ntr/article-lookup/doi/10.1093/ntr/ntv074.
35. Singh NN, Lancioni GE, Myers RE, Karazsia BT, Winton ASW, Singh J. A randomized controlled trial of a mindfulness-based smoking cessation program for individuals with mild intellectual disability. Int J Ment Health Addict [Internet]. 2014;12:153–68 Available from: http://link.springer.com/10.1007/s11469-013-9471-0.
36. Vidrine JI, Spears CA, Heppner WL, Reitzel LR, Marcus MT, Cinciripini PM, et al. Efficacy of mindfulness-based addiction treatment (MBAT) for smoking cessation and lapse recovery: a randomized clinical trial. J Consult Clin Psychol [Internet]. 2016;84:824–38.
37. Maglione MA, Maher AR, Ewing B, Colaiaco B, Newberry S, Kandrack R, et al. Efficacy of mindfulness meditation for smoking cessation: a systematic review and meta-analysis. Addict Behav [Internet]. 2017;69:27–34 Available from: https://linkinghub.elsevier.com/retrieve/pii/S030646031730031X.
38. Bowen S, Chawla N, Collins SE, Witkiewitz K, Hsu S, Grow J, et al. Mindfulness-based relapse prevention for substance use disorders: a pilot efficacy trial. Subst Abus. 2009;30:295–305.
39. Mermelstein LC, Garske JP. A brief mindfulness intervention for college student binge drinkers: a pilot study. Psychol Addict Behav [Internet]. 2015;29:259–69 Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/adb0000040.
40. Szeto EH, Schoenmakers TM, van de Mheen D, Snelleman M, Waters AJ. Associations between dispositional mindfulness, craving, and drinking in alcohol-dependent patients: an ecological momentary assessment study. Psychol Addict Behav [Internet]. 2019;33:431–41 Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/adb0000473.
41. Enkema MC, Bowen S. Mindfulness practice moderates the relationship between craving and substance use in a clinical sample. Drug Alcohol Depend [Internet]. 2017;179:1–7 Available from: https://linkinghub.elsevier.com/retrieve/pii/S0376871617303137.
42. Imani S, Atef Vahid MK, Gharraee B, Noroozi A, Habibi M, Bowen S. Effectiveness of mindfulness-based group therapy compared to the usual opioid dependence treatment. Iran J Psychiatry [Internet]. 2015;10:175–84 Available from: http://www.ncbi.nlm.nih.gov/pubmed/26877751.
43. Garland EL, Hanley AW, Kline A, Cooperman NA. Mindfulness-oriented recovery enhancement reduces opioid craving among individuals with opioid use disorder and chronic pain in medication assisted treatment: ecological momentary assessments from a stage 1 randomized controlled trial. Drug Alcohol Depend [Internet]. 2019;203:61–5 Available from: http://www.ncbi.nlm.nih.gov/pubmed/31404850.
44. Vowles KE, Witkiewitz K, Cusack KJ, Gilliam WP, Cardon KE, Bowen S, et al. Integrated behavioral treatment for veterans with co-morbid chronic pain and hazardous opioid use: a randomized controlled pilot trial. J Pain Off J Am Pain Soc [Internet]. 2019.

45. Edwards KA, Vowles KE, Witkiewitz K. Co-use of alcohol and opioids. Curr Addict Reports [Internet]. 2017;4:194–9 Available from: http://link.springer.com/10.1007/s40429-017-0147-x.
46. Gearhardt AN, Davis C, Kuschner R, Brownell KD. The addiction potential of hyperpalatable foods. Sharjah: Bentham Science Publishers.
47. Gearhardt AN, Boswell RG, White MA. The association of "food addiction" with disordered eating and body mass index. Eat Behav Elsevier Ltd. 2014;15:427–33.
48. Kristeller J, Wolever RQ, Sheets V. Mindfulness-Based Eating Awareness Training (MB-EAT) for binge eating: a randomized clinical trial. Mindfulness (N Y) [Internet]. 2014;5:282–97 Available from: http://link.springer.com/10.1007/s12671-012-0179-1.
49. Levoy E, Lazaridou A, Brewer J, Fulwiler C. An exploratory study of mindfulness based stress reduction for emotional eating. Appetite [Internet]. 2017;109:124–30 Available from: https://linkinghub.elsevier.com/retrieve/pii/S019566631630825X.
50. Katterman SN, Kleinman BM, Hood MM, Nackers LM, Corsica JA. Mindfulness meditation as an intervention for binge eating, emotional eating, and weight loss: a systematic review. Eat Behav [Internet]. 2014;15:197–204 Available from: http://www.ncbi.nlm.nih.gov/pubmed/24854804.
51. McIntosh CC, Crino RD, O'Neill K. Treating problem gambling samples with cognitive behavioural therapy and mindfulness-based interventions: a clinical trial. J Gambl Stud [Internet]. 2016;32:1305–25 Available from: http://www.ncbi.nlm.nih.gov/pubmed/27040973.
52. Toneatto T, Pillai S, Courtice EL. Mindfulness-enhanced cognitive behavior therapy for problem gambling: a controlled pilot study. Int J Ment Health Addict [Internet]. 2014;12:197–205 Available from: http://link.springer.com/10.1007/s11469-014-9481-6.
53. Shead NW, Champod AS, MacDonald A, et al. Int J Ment Health Addict [Internet]. 2019; Available from: http://link.springer.com/10.1007/s11469-019-00133-x.
54. Maynard BR, Wilson AN, Labuzienski E, Whiting SW. Mindfulness-based approaches in the treatment of disordered gambling: a systematic review and meta-analysis. Res Soc Work Pract [Internet]. 2018;28:348–62 Available from: http://journals.sagepub.com/doi/10.1177/1049731515606977.
55. Kuss DJ, Griffiths MD. Internet gaming addiction: a systematic review of empirical research. Int. J. Ment. Health Addict. 2012:278–96.
56. Smyth JM. Beyond self-selection in video game play: an experimental examination of the consequences of massively multiplayer online role-playing game play. Cyberpsychology Behav. 2007;10:717–21.
57. Chappell D, Eatough V, Davies MNO, Griffiths M. EverQuest - it's just a computer game right? An interpretative phenomenological analysis of online gaming addiction. Int J Ment Health Addict. 2006;4:205–16.
58. Li W, Garland EL, Mcgovern P, O'brien JE, Tronnier C, Howard MO. Mindfulness-oriented recovery enhancement for internet gaming disorder in U.S. adults: a stage I randomized controlled trial. Psychol Addict Behav. 2017;31:393–402.
59. Li W, Garland EL, Howard MO. Therapeutic mechanisms of mindfulness-oriented recovery enhancement for internet gaming disorder: reducing craving and addictive behavior by targeting cognitive processes. J Addict Dis [Internet]. Li, Wen, Rutgers, The State University of New Jersey, School of Social Work, 536 George Street, New Brunswick, NJ, US, 08901: Taylor & Francis. 2018;37:5–13.
60. Yao YW, Chen PR, Li C, Shan R, Hare TA, Li S, et al. Combined reality therapy and mindfulness meditation decrease intertemporal decisional impulsivity in young adults with Internet gaming disorder. Comput Human Behav [Internet]. Elsevier Ltd. 2017;68:210–6. https://doi.org/10.1016/j.chb.2016.11.038.
61. Roos CR, Bowen S, Witkiewitz K. Baseline patterns of substance use disorder severity and depression and anxiety symptoms moderate the efficacy of mindfulness-based relapse prevention. J Consult Clin Psychol [Internet]. 2017;85:1041–51.